

# **Puget Sound Chinook Salmon ESU**

Artificial Propagation Review

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- The Puget Sound TRT delineated 22 currently extant populations within the ESU (31 were historically present).**
- 42 chinook salmon hatchery programs operate within the ESU (8 "conservation", 34 "harvest augmentation").**
- Current ESU-wide juvenile hatchery chinook production: 48 million (45.7 million sub-yearlings and 2.3 million yearlings) per year. 20 million "in ESU"; 28 million "of of ESU").**
- 12 of the 22 independent populations have associated hatchery populations founded directly or that represent extant natural spawning populations in the watersheds (10 do not).**
- Of the 42 total hatchery programs, 26 (62%) propagate fall chinook originally derived from the Green River population or its hatchery derivatives. 23 of the 26 located outside of the Green River watershed.**
- Production from these 26 "Green River lineage" hatchery programs comprises 77% of ESU-wide annual juvenile chinook release total.**







# BRT Concerns - PS Chinook ESU

(BRT, 2003)

- 9 of 31 historic populations are extinct – most were early run fish;
- Majority of natural production concentrated in just two basins;
- High levels of hatchery production in many areas of the ESU;
- Widespread loss of estuary and lower floodplain habitat diversity (and, likely, associated life history types).
- Most populations relatively small, and recent natural production only a fraction of estimated historic run size .
- (Unknown fractions of hatchery fish in natural spawning areas confounds NOR VSP assessments (mass marked returns beginning with 2004 return year through).

ESU = "Threatened" ("moderately high risks in all VSP elements").

# Chinook Populations In the ESU

- N.F. Nooksack natural, including Kendall Creek SH fish;
- S.F. Nooksack natural;
- Lower Skagit natural, including Marblemount SH Fall fish;
- Upper Skagit natural, including Marblemount SH Summer fish;
- Upper Cascade natural, including Marblemount SH Spring fish;
- Lower Sauk natural;
- Upper Sauk natural;
- Suiattle natural;

# Chinook Populations In the ESU — cont.

- N.F. Stillaguamish natural, including Harvey Creek FH/Whitehorse Springs SH.
- S.F. Stillaguamish natural;
- Skykomish natural, including Wallace River SH Summer, and Tulalip Bay FH Summer;
- Snoqualmie natural;
- N. Lake Washington natural;
- Cedar natural;
- Green River natural, including Soos Creek SH, Icy Creek SH, and Keta Creek FH;



# **Chinook Populations In the ESU – cont.**

- White natural, including White River FH, White River Acclimation Ponds, and Hupp Springs SH;
- Puyallup natural, including Voights Creek SH and Diru Creek FH;
- Nisqually natural, including Clear Creek FH and Kalama Creek FH;
- Skokomish natural;
- Westside Hood Canal natural;
- Dungeness natural, including Dungeness SH;
- Elwha natural, including Elwha SH.

# Chinook Populations Out of the ESU

- Lummi Bay FH program fish;
- Samish SH program fish;
- Glenwood Springs FH program fish
- Tulalip Bay FH Spring program fish;
- Tulalip Bay FH Fall program fish;
- UW Portage Bay FH program fish;
- Issaquah SH program fish;
- Grovers Creek FH program fish;
- Minter Creek SH program fish;
- Tumwater Falls SH program fish;
- George Adams SH program fish;
- Rick's Pond FH program fish;
- Hoodsport SH program fish;
- Hamma Hamma FH program fish; and
- Big Beef Creek FH program fish.



# In ESU Hatchery Program Inventory (22 Programs)

Population/Program	Iso/Integ	Purpose	Release #s / Type	Adults/ Year
NK Nooksack Kendall Creek SH	Integrated	Conservation	800K eyed egg/presmolt/smolt	4,058
Lower Skagit Marblemount SH Fall	Integrated	Research	222K sub-yearlings	Unknown
Upper Skagit Marblemount SH Summer	Integrated	Research	200K sub-yearlings	~150
Upper Cascade Marblemount SH Spring	Isolated	Research	4.0 mil. sub-yearling/100K yearling	1,618
NF. Stillaguamish Harvey Creek FH	Integrated	Conservation	200K sub-yearling smolt	483
Whitehorse Pond SH	Integrated	Conservation		

# In ESU Hatchery Program Inventory

Population/Program	Iso/Integ	Purpose	Release #s / Type	Adults/ Year
<b>Skykomish</b>				
Wallace River SH	Integrated	Harvest	1.0 mil sub-yearling/250K yearlings	2,040
Tulalip Bay FH Summer	Isolated	Harvest	1.5 mil sub-yearlings	~7,000
<b>Green</b>				
Soos Creek SH	Integrated	Harvest	3.2 mil sub-yearlings	9,938
Icy Creek SH	Integrated	Harvest	300K yearlings	2,381
Keta Creek FH	Integrated	Harvest	600K fingerlings	21
<b>White</b>				
White River FH	Integrated	Conservation	260K sub-yearlings/ 90K yearlings	652
White Acclimation Pond	Integrated	Conservation	840K fingerlings	
Hupp Springs SH	Integrated	Conservation	250K sub-yearlings/ 85K yearlings	958 (h/w)
				424

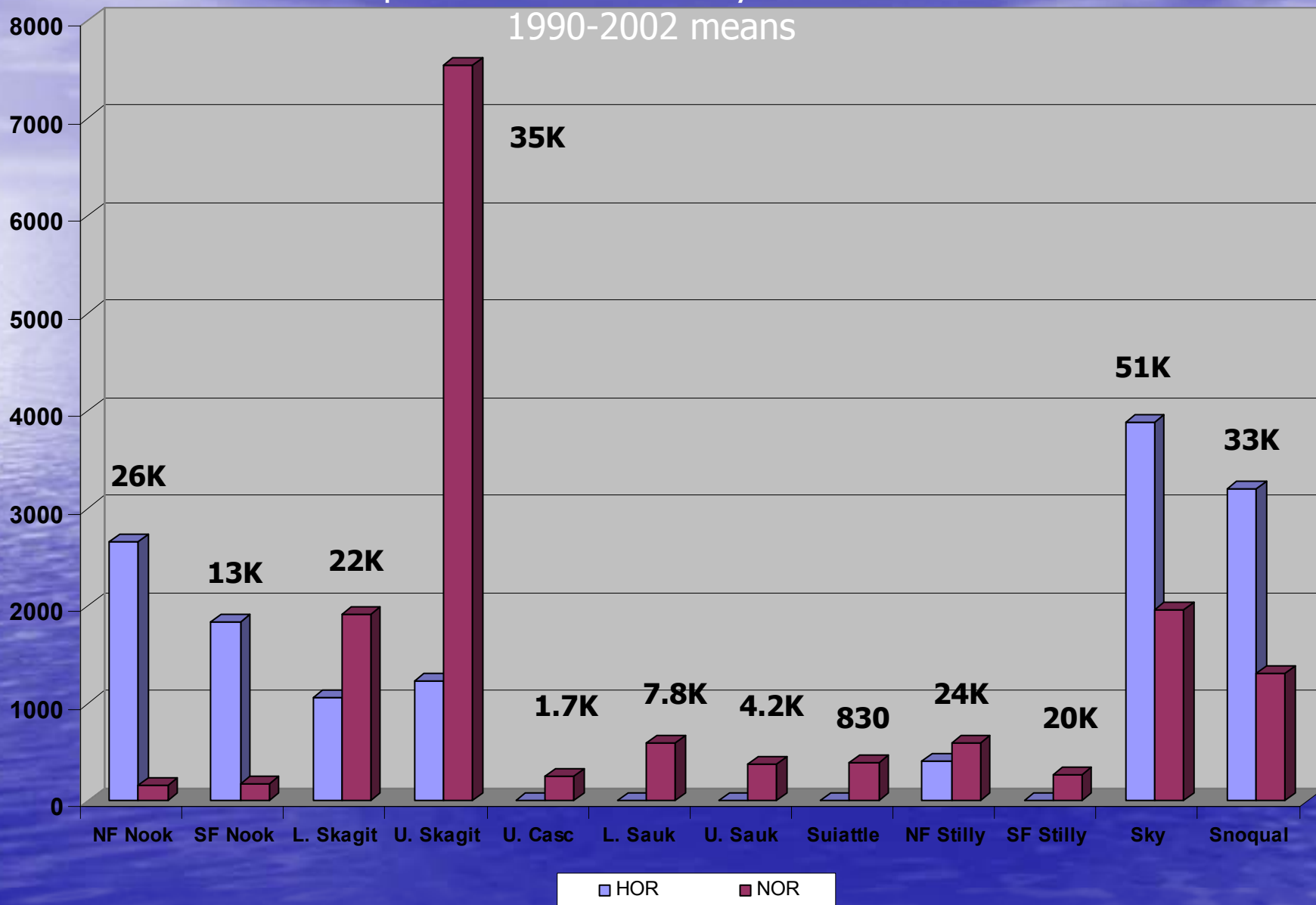


# In ESU Hatchery Program Inventory

Population/Program	Iso/Integ	Purpose	Release #s / Type	Adults/ Year
<b>Puyallup</b>				
Vrights Creek SH	Integrated	Harvest	1.6 mil sub-yearlings	3,078
Dru Creek FH	Integrated	Harvest	400K sub-yearlings	~2,000
<b>Nisqually</b>				
Clear Creek	Isolated	Harvest	3.4 mil sub-yearlings	5,430
Kalama Creek	Isolated	Harvest	600K sub-yearlings	
<b>Dungeness</b>				
Dungeness River SH	Integrated	Conservation	2.0 mil fingerlings/sub-yearlings	Unknown
<b>Elwha</b>				
Elwha Channel SH	Integrated	Conservation	3.85 mil sub-yearlings	Unknown

# Population Area Abundances

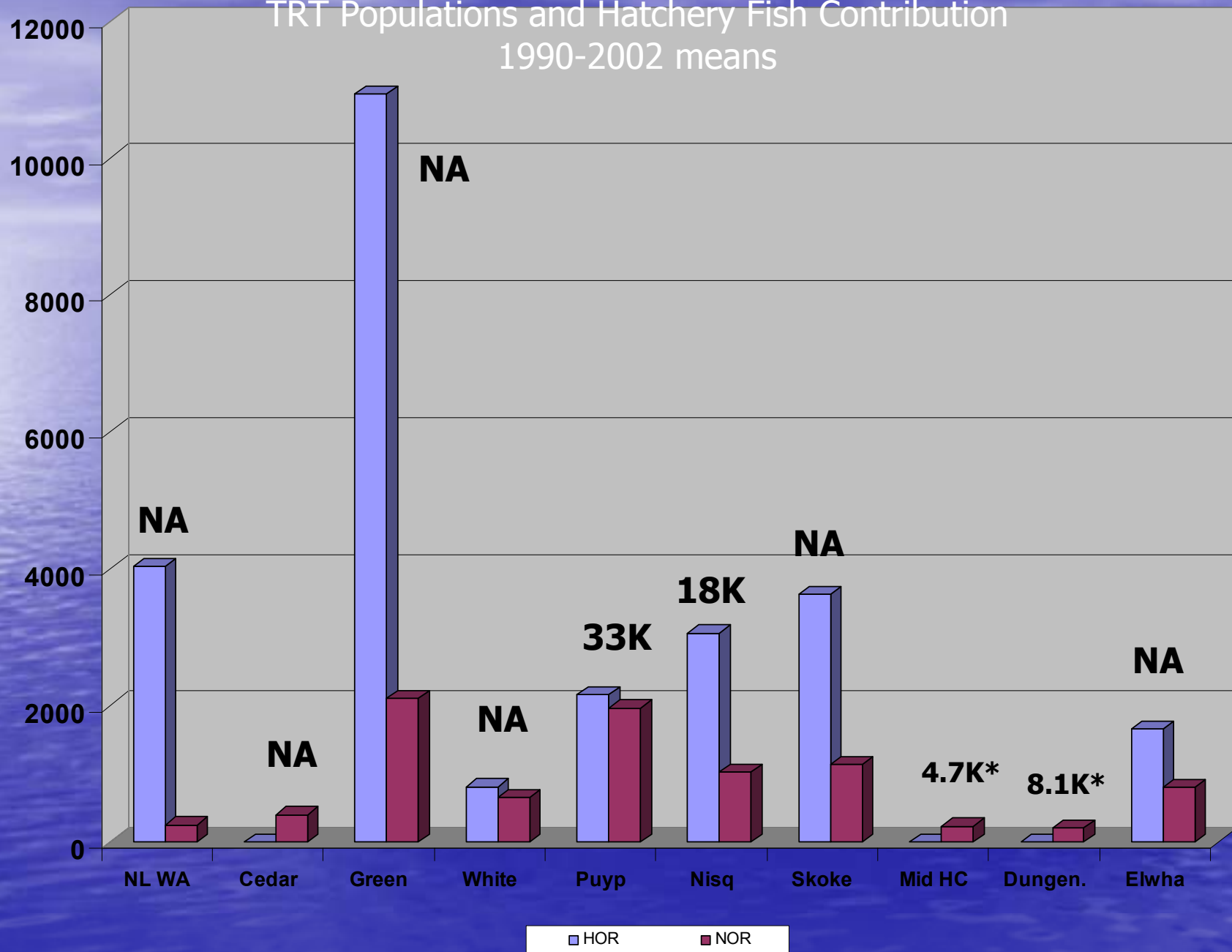
## TRT Populations and Hatchery Fish Contribution





# Population Area Abundances

TRT Populations and Hatchery Fish Contribution  
1990-2002 means







*"The effects of hatchery fish on the likelihood of extinction of an ESU, depend on how hatchery fish affect four key attributes"*



# Abundance

- The 22 hatchery chinook programs are increasing the abundance of naturally spawning chinook salmon for 12 of 22 TRT populations.
- 8 programs of the 22 are purposely preserving or increasing the abundance of naturally spawning chinook populations and likely prevented further extirpations.
- Remaining 14 programs (all harvest aug) have inadvertently increased numbers of natural spawners via strays.
- No evidence that any of the 22 programs have led to an increase in abundance of natural-origin fish even after decades of infusion/straying of hatchery fish in natural spawning areas.
- Total ESU abundance remains well below estimated historical abundance.

# Productivity

- There is no indication that the hatchery programs are increasing the productivity of the 22 extant populations. Both need functioning natural habitat (e.g., estuaries).
- NOR trends remain flat (replacement levels or worse) for all populations with HOR chinook contributing to natural spawning areas.
- Increasing annual proportions of HORs relative to NORs on spawning grounds for some populations (e.g., NF Stillaguamish, NF Nooksack).



# Spatial Structure

- 11 of 22 programs are benefiting/preserving spatial structure of associated natural populations (increased spawning area use within watersheds with increased total abundance; 4 above dam planting programs).
- Remaining programs return fish to hatchery rack; minimal contribution.
- Upstream passage re-established at several locations (Wallace, Soos, Voights, (Elwha)

# Diversity

- 8 conservation programs have preserved genetic diversity within ESU. Extirpations and loss of total ESU diversity prevented for several populations.
- Integrated harvest augmentation programs have in nearly all cases maintained high effective breeding population sizes (e.g., Soos Creek  $N_e \approx 14,400$ ); reserves for associated natural populations.
- Most of 22 programs apply measures to maintain genetic diversity (use native or extant stocks, appropriate broodstock collection and mating protocols (Hatchery reform)).
- High production proportion and widespread propagation of Green River hatchery lineage fish: among population diversity reduction risk.

# Effect of Artificial Propagation on VSP Attributes

Viability Criteria	BRT VSP Risk Score	Decreases Risk	Neutral or Uncertain	Increases Risk
Abundance	3.3	✓		
Productivity	3.6		✓	
Spatial Structure	2.9	✓		
Diversity	3.2		✓	



# Hatchery Effect on BRT Status Finding for Puget Sound Chinook Salmon ESU

		Endangered	Threatened	Not warranted
% of BRT Votes		8%	74%	18%
SRD Finding			X	

Summary: Increased abundance with hatchery fish associated predominately with propagation of one of 22 TRT populations (Green). ESU has plenty of Green River lineage fish. Composite abundances for other populations well below targets. Hatchery fish spawning in the wild not changing flat NOR productivity trends. Some spatial structure benefits for 1/2 of the populations. Diversity benefits off-set by homogenization risks.